

Impact of Calibrated Land Surface Model Parameters on the Accuracy and Uncertainty of Land-Atmosphere Coupling in WRF Simulations

Joseph A. Santanello, Jr.¹, Sujay V. Kumar^{2,1}, Christa D. Peters-Lidard¹,

Ken Harrison^{3,1}, and Shujia Zhou^{4,1}

Land-atmosphere (L-A) interactions play a critical role in determining the diurnal evolution of both planetary boundary layer (PBL) and land surface temperature and moisture budgets, as well as controlling feedbacks with clouds and precipitation that lead to the persistence of dry and wet regimes. Recent efforts to quantify the strength of L-A coupling in prediction models have produced diagnostics that integrate across both the land and PBL components of the system. In this study, we examine the impact of improved specification of land surface states, anomalies, and fluxes on coupled WRF forecasts during the summers of extreme dry (2006) and wet (2007) land surface conditions in the U.S. Southern Great Plains. The improved land initialization and surface flux parameterizations are obtained through the use of a new optimization and uncertainty estimation module in NASA's Land Information System (LIS-OPT/UE), whereby parameter sets are calibrated in the Noah land surface model and classified according to a land cover and soil type mapping of the observation sites to the full model domain. The impact of calibrated parameters on the a) spinup of the land surface used as initial conditions, and b) heat and moisture states and fluxes of the coupled WRF simulations are then assessed in terms of ambient weather and land-atmosphere coupling along with measures of uncertainty propagation into the forecasts. In addition, the sensitivity of this approach to the period of calibration (dry, wet, average) is investigated. Finally, tradeoffs of computational tractability and scientific validity, and the potential for combining this approach with satellite remote sensing data are also discussed.